

Conference Reports

Workshop on the Economic and Environmental Impacts of Biobased Production

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Introduction

The Workshop on the Economic and Environmental Impacts of Biobased Production was convened at the Hotel Allegro in Chicago, Illinois on June 8th and 9th, 2004 under the auspices of the University of Illinois at Chicago, Institute for Environmental Science and Policy and the National Science Foundation's Biocomplexity in the Environment MUSES (Materials Use: Science, Engineering and Society) program.

The overall goal of the workshop was to continue to expand the dialogue on bio-based production in the research and business community, to address life cycle issues surrounding bio-based production, to interject economic and policy elements, and to seek a synthesis among these areas. This workshop is envisioned as complimentary to previous workshops and symposia on this topic which focused principally on the scientific and technical aspects e.g. (Dartmouth 2001, AIChE 2002, Oklahoma 2003). Throughout the workshop, emphasis was placed on the inclusion of economics and policy elements of biobased production, and how these inform and in turn are informed by scientific and technical findings. This symphony is viewed as an essential step in assessing the environmental sustainability of bio-based production. The format of the workshop consisted of three plenary sessions, each of which was followed by breakout groups. Workshop participants represented a wide variety of backgrounds, with 50% of the participants from academia, 22% from government organizations and laboratories, 22% from the business sector, and 6% from other organizations.

The breakout groups used a technique known as 'shared inquiry' to direct discussion and elicit innovative thoughts and ideas. Shared inquiry is a distinctive method of learning in which participants search for answers to fundamental questions. Discussions were enhanced by incorporation of concepts from the plenary session presentations. Several pre-selected texts (Simon 1996, Brown 1998, McDonough and Braungart 2002, Moomaw 2002) were made available to participants beforehand to provide the initial focus for the breakout sessions, which were led by moderators from the Great Books Foundation. Most workshop participants (70%) agreed that the breakout sessions themselves provided a useful opportunity for new ideas and issues to emerge. For more information on Shared Inquiry, please visit the Great Books Foundation at www.greatbooks.org.

1 Plenary Sessions

The workshop consisted of three plenary sessions (Session I: visions of bio-refineries and sustainable bio-production, Session II: economic and agricultural environmental impacts, Session III: bio-energy and greenhouse gases with a global perspective). Workshop details, speaker biographies, and plenary session presentations are available on the web from the Institute for Environmental Science and Policy at <http://www.uic.edu/depts/ovcr/iesp/MUSES/wkshpHome.html>.

The conference commenced with an expansive look at biobased production in Session I and included talks from Professor LEE LYND of Dartmouth University ('Prospects for achieving large sustainability and security benefits via biomass-based processes'), Mr. JOHN SHEEHAN of the National Renewable Energy Laboratory ('Toward a vision of sustainable biomass: Adventures at the intersection of technology, economics, ethics and politics'), and Professor FRANCIS EPPLIN of Oklahoma State University ('Lignocellulosic biomass as biorefinery feedstock: Benefits and challenges'). Speakers stressed the necessity for technology development and life cycle analyses which aim toward non-traditional biobased feedstocks (for example grasses, forestry, residues) that could be used to produce a host of products. They suggested that the development of cost competitive bio-based products or biorefining systems would utilize a variety of feedstocks based on crop availability.

The economics plenary session (Session II) integrated presentations from Professor ROBERT ANEX of Iowa State University ('An economic basis for biorenewable resource policy in a resource-constrained world: Economics, thermodynamics and biorenewable resources'), Professor BRUCE MCCARL of Texas A&M University ('Climate change mitigation as a stimulus for biofuel adoption: An economic evaluation'), and Dr. SUZIE GREENHALGH of the World Resources Institute ('Impacts of agricultural production on water quality and a possible policy solution'). The tradeoffs associated with increased agricultural production (in distinction to petro-based) were an emerging theme. Speakers pointed to the potentially irreversible environmental impacts created from excess nitrogen and phosphorus loads from agricultural systems as well as to the issues of changes in soil fertility and erosion. The proportional increase in usage of pesticides and genetically modified crops was estimated to create additional and potentially unknown environmental burdens. Finally, several policy and regulatory options were explored.

The conference wrapped up with a focus on biofuels and their global market in Session III. The final plenary session incorporated talks from Dr. MICHAEL WANG of Argonne National Laboratory ('Energy and greenhouse gas emission impacts of fuel ethanol'), Dr. JOSE MORIERA of University of Sao Paulo ('Global biomass energy potential'), and Professor SATISH JOSHI of Michigan State University ('Towards a sustainable personal transport sector: Evaluation of large scale adoption of bio-based fuels'). Greenhouse gases from the transportation and energy sectors were emphasized. The issue of utilizing high value crops for higher value-added commodities was discussed in terms of relating the quality of energy produced to the quality of feedstock. The global market for bio-fuels was also presented.

2 Analysis of Workshop Outcomes

The paths and technologies which will contribute to the evolution of biobased products are unknown. However, a consensus at the workshop was reached on the need for maximized crop utilization and increased production efficiencies. For example, co-product generation and use will need to be evaluated both from a technical and life cycle perspective. The utilization of a multitude of bio-sources and feedstocks was deemed a necessity for the advancement of bioproducts. The workshop participants agreed that the life cycle community must be ready to account for the environmental impacts of using these new crops.

2.1 Economics and market development

Policies within the United States that impact bio-based production tend to promote the view of biomaterials solely in the context of US resources (corn, soybeans and switchgrasses) and markets. The capability of other countries to more cheaply produce bio-products from resources not readily farmed in the US is an important factor that may greatly influence global bio-product development. Many questions remain; for example, how might current US import tariffs, regulations, and subsidies play an important role in the innovation and development of bio-product technology and markets? What might the global market look like if energy and product needs were to be supplied not from OPEC countries but from agriculturally strong nations?

2.2 Research tools and data needs

In order for the realms of economics, technology and policy to interconnect for the advancement of bio-based products, a multidisciplinary approach is required. LCA-type tools and assessments should be expanded, and uncertainty and variability should be incorporated into analyses. This latter factor is particularly important for non-point sources of contamination, where the variability of natural factors bring about substantial variations for observed emission rates. A new certification system may be valuable for data acquisition, openness, and transparency within analyses to ensure that the underlying assumptions are available for interpre-

tation. The spatial and temporal scale of the analysis is also very important to consider in LCA. For example, for different applications there may be different definitions of the most useful and important scale (local, regional, global, 5, 50, 500 years).

Several potential impacts and environmental considerations have thus far been overlooked by most life cycle approaches to bio-based production. Greenhouse gases and fuel usage tend dominate life cycle thinking in spite of the importance of agricultural nutrient flows. The incorporation of the impacts of genetically modified plants is also an important factor to include if the global reliance on agricultural systems increases.

2.3 Stakeholder involvement

The promotion of greater interdisciplinary approaches to research within the technical community is critical if the vision of bio-based product development is to be communicated. It is important to preserve the complexity of life cycle data within the analyses while simultaneously conveying the meaning in common sense terms to stakeholders and policy makers. In attempting to advise policy and communicate to stakeholders, the identification of institutional barriers to change is an important step for beginning conversations outside of the engineering and life cycle disciplines, for instance one such barrier is the poor coordination of portfolios among research funding agencies.

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